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Supplementary materials for 'Further investigations of how rare disaster information affects risk taking: A registered replication report'

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Unpublished follow-up experiments

The results of Newell, Rakow, Yechiam, and Sambur (2016) inspired two broad lines of research each with two experiments. These lines were (1) the effect of historical information, and (2) the effect of loss framing. These four experiments used a between-subjects design including feedback and either history, or frame as factors.

Across experiments, the all-villages feedback condition was compared to one of the other feedback conditions i.e. local-village or own-house. This replicated the original comparison between the more-informed conditions that received forgone feedback across the micro-world, and those conditions receiving less (i.e. forgone feedback for only the selected village, or experienced feedback for only the selected house). The levels of the new experimental factors similarly allowed for replication of the conditions in Newell et al. (2016). In the two history experiments, participants either received additional historical information, or this information was absent as in Newell et al. (2016). Likewise in the two framing experiments, the experiment was framed either as round-by-round losses due to rental payment, or in the original mixed framing where points were gained on non-disaster trials and lost to disasters. Taken together, the experimental design in each of the four experiments allowed for the replication and extension of the disaster information effect.

In the following sections we will provide additional detail and results for four follow-up experiments.

History manipulation

The novel manipulation in the two history experiments was the addition of historical information to the micro-world. This manipulation provided the disaster history for an individual house. If a house was affected by a disaster in the previous 50 trials, it was filled in red on the map. This house would remain so for a 50 trial window (see the green Risky 2 village in Figure 1). On each round, the map was visually updated such that if the house was hit again in the current round, it was coloured black, and the 50-trial window was reset. If no disasters occurred in the previous 50 trials, the house returned to the default unfilled appearance. Depending on the feedback condition, the disaster report located in the lower right corner of the map also stated the percentage of houses that were hit in the previous 50 rounds. Together, the history manipulation provided participants a visual and numerical representation of the long-term disaster risks. The presence of historical information was predicted to reduce the proportion of risky choices compared to conditions in which historical information was absent.

Figure 1. Screenshot of the micro-world for a participant in the all-villages feedback history condition. The current chosen house is highlighted in yellow. For this participant, Village 'Risky 2' was green and located in the top right corner of the map. Houses hit by a disaster in the current round are filled in black. Red-filled squares indicate houses that were affected by a disaster within a 50-trial history window. Disaster reports in the bottom right quadrant also state the percentage of houses within a village that were affected by a disaster within the history window.

Experimental design. The two history experiments, numbered 3 and 4 in Figure 2, were identical with $N = 120$. Participants made 200 choices under each environment in a fixed environment order; moderate then severe. Environment was therefore the within-subjects factor. The between-subjects factors were feedback (all-villages & local-village) and history (history present & history absent). Details about the payoff distributions in each environment are included in Table 1. The dependent variable was the proportion of risky choices and this was analysed using a mixed ANOVA.

Table 1

Payoff distributions within each environment

	Moderate environment			Severe environment		
	Safe	Risky 1	Risky 2	Safe	Risky 1	Risky 2
Payment/round	10	15	15	10	15	15
Disaster damage	N/A	-541	-541	N/A	-819	-819
P(disaster)	0	0.01	0.10	0	-0.01	0.10
P(negative event|disaster)	N/A	0.90	0.09	N/A	0.90	0.09
Therefore, P(negative event)	0	0.009	0.009	0	0.009	0.009
Expected value (per round)	+10	+9.996	+9.996	+10	+7.494	+7.494

Note. Payment/round is the average amount participants win per round if no negative event affects their dwelling. Disaster damage is the average amount participants lose if a negative event affects their dwelling. The variability around each mean outcome was drawn from a uniform distribution of integers, U [-3, +3]. The probability of disaster, p(disaster), refers to the probability that a disaster will affect a region; the probability of a negative event given that a disaster hits, P(negative event|disaster, refers to the extent of damage in the region. The information in bold was available to participants; risks were presented as relative frequencies (for example, 1 in 100 rather than 0.01). N/A, not applicable.

Results of the history experiments. Results for the history experiments are presented in Figure 2. Risky choice proportions are shown as a function of the experiment number (3/4), history factor (absent/present), and the feedback condition (all-village/local). Note that the data in Figure 2 has been collapsed across environment (moderate/severe).

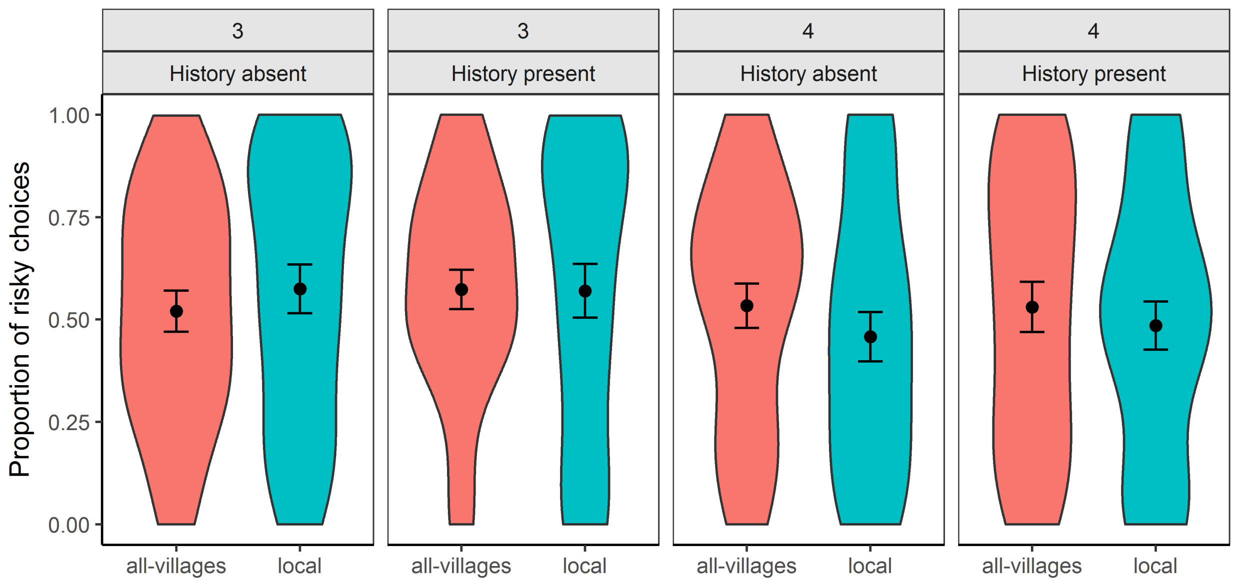

Figure 2. Risky choice proportion as a function of experiment number, history, and feedback condition (all between-subjects). Error bars depict standard error of the mean. 'All-villages' refers to receiving feedback about the occurrence of disasters in all of the villages in the micro-world, and 'local' refers to receiving feedback only about disasters occurring in the village that the participant is currently living.

In Experiment 3, shown in the two left-most panels, there was a significant effect of environment, $F(1, 116) = 20.14$, $p < .001$, such that risky choice proportions were higher in the moderate environment than the severe environment. Notably, there was insufficient evidence to suggest an effect of history, $F(1, 116) = .18$, $p = .67$, or an effect of feedback, $F(1, 116) = .21$, $p = .65$.

In Experiment 4, shown in the two right-most panels, there was a significant environment × feedback interaction, $F(1,\, 116) = 6.56$, $p = .01$. This was explained by a higher proportion of risky choices in the all-villages condition compared to the local-village condition in the moderate environment. However, there was insufficient evidence of a feedback main effect, $F(1,\, 116) = 1.06$, $p = .31$. Compared to the original published findings, Newell et al. (2016) found that the feedback effect held over both environments. Additionally, there was insufficient evidence to suggest an effect of history on risky choice proportions, $F(1,\, 116) = .04$, $p = .84$, though there was an effect of block, $F(3,\, 348) = 4.16$, $p = .007$, captured by the decrease in risky choice proportions over the experiment.

Overall, Experiments 3 & 4 failed to replicate the disaster information effect. In Experiment 3, we saw a reversal in the pattern of means for each feedback condition. Although the expected pattern of means was numerically, but not statistically, present in Experiment 4, the stability of the effect remains in question especially given the two experiments were identical.

Loss framing manipulation

In the loss framing, participants began the experiment with a 10,000 point endowment from which round-by-round 'rent' payments were subtracted. The exact endowment amount was selected to ensure parity between the new 'losses', and previous 'mixed' framing conditions. The 'rent' in the safe village was higher though without the risk of a disaster. Comparatively, round-by-round rental payments in the risky villages were lower and accompanied by exposure to disasters. The full payoff distributions for the loss framing are shown in Table 2. The payoffs for the mixed framing are shown above in Table 1.

Experimental design. In Experiment 5, the between-subjects factors were feedback (all-villages vs. local-village/own), frame (mixed/losses), and environment order (moderate to severe/severe to moderate). The environment order factor was included to replicate the two experiments in Newell et al. (2016) that independently found the disaster information effect under the two environment orderings. Experiment 5 was intended to test the

Table 2

Payoff distributions within each environment in the loss framing

	Moderate environment			Severe environment		
	Safe	Risky 1	Risky 2	Safe	Risky 1	Risky 2
Payment/round	-15	-10	-10	-15	-10	-10
Disaster damage	N/A	-566	-566	N/A	-844	-844
P(disaster)	0	0.01	0.10	0	-0.01	0.10
P(negative event|disaster)	N/A	0.90	0.09	N/A	0.90	0.09
Therefore, P(negative event)	0	0.009	0.009	0	0.009	0.009
Expected value (per round)	-15	-15.004	-15.004	-15	-17.506	-17.506

Note. Payment/round is the average amount participants pay per round if no negative event affects their dwelling. Disaster damage is the average amount participants lose if a negative event affects their dwelling. The variability around each mean outcome was drawn from a uniform distribution of integers, U [-3, +3]. The probability of disaster, p(disaster), refers to the probability that a disaster will affect a region; the probability of a negative event given that a disaster hits, P(negative event|disaster, refers to the extent of damage in the region. The information in bold was available to participants; risks were presented as relative frequencies (for example, 1 in 100 rather than 0.01). N/A, not applicable.

robustness of ordering effect within the one experiment.

The intended sampling plan of $n = 25$ consisted of between-subject conditions of 2 feedback $\times$ 2 frame $\times$ 2 environment order ($N = 200$). Experimental collection errors deviated from this plan; insufficient n's were collected for some conditions with excess in others. To remedy this, a further 58 participants were collected in the deficient conditions until $n = 25$. For the conditions with additional participants, fixed $n = 25$ groups were randomly sampled for analysis.

Experiment 6 was identical except for two changes. First, the environment order was fixed from moderate to severe, and second, the feedback factor compared the all-villages condition to the local-village condition. This reduced Experiment 6 to a 2 feedback (all-villages/local) $\times$ 2 frame (mixed, losses) between-subjects design with environment (moderate/severe) as a within-subjects factor. Our intended sampling plan was to collect $N = 160$. However, the semester ended prior to the completion of collection resulting in a total $N = 139$.

Results of framing experiments. Results for the framing experiments are presented in Figure 3. Risky choice proportions are shown as a function of the experiment number (5 or 6), framing (mixed or losses), and feedback condition (all-village vs. local-village or own-house). Again the data in Figure 3 has been collapsed across environment for both experiments, and across environment order in Experiment 5.

First examining Experiment 5, there was a main effect of environment, $F(1, 192) = 8.40$, $p = .004$, which was qualified by an environment $\times$ order interaction, $F(1, 192) = 13.07$, $p < .001$. This was explained by the higher proportions of risky choice in the moderate environment compared to the severe environment when the moderate environment was experienced first (ordering 1) compared to when the severe environment was experienced first (ordering 2). Put differently, experiencing the severe environment first (ordering 2) produced a persistence in risky choices proportions across the two environments. This effect replicated the pattern observed across two experiments within Newell et al. (2016). The main effect of block, $F(3, 576) = 7.27$, $p < .001$, was informed by a block $\times$ frame interaction, $F(3, 576) = 4.50$, $p = .004$. This is explained by risky choice proportions declining over the course of the experiment in the mixed framing, yet remaining relatively stable in the loss framing.

Examining the two left panels of Figure 3, there was a significant effect of framing, $F(1, 192) = 7.17$, $p = .008$, whereby risky choice proportions were higher in the losses framing than in the mixed framing. Despite the suggestion of an interaction in Figure 3, there was insufficient evidence to suggest a feedback $\times$ framing interaction,

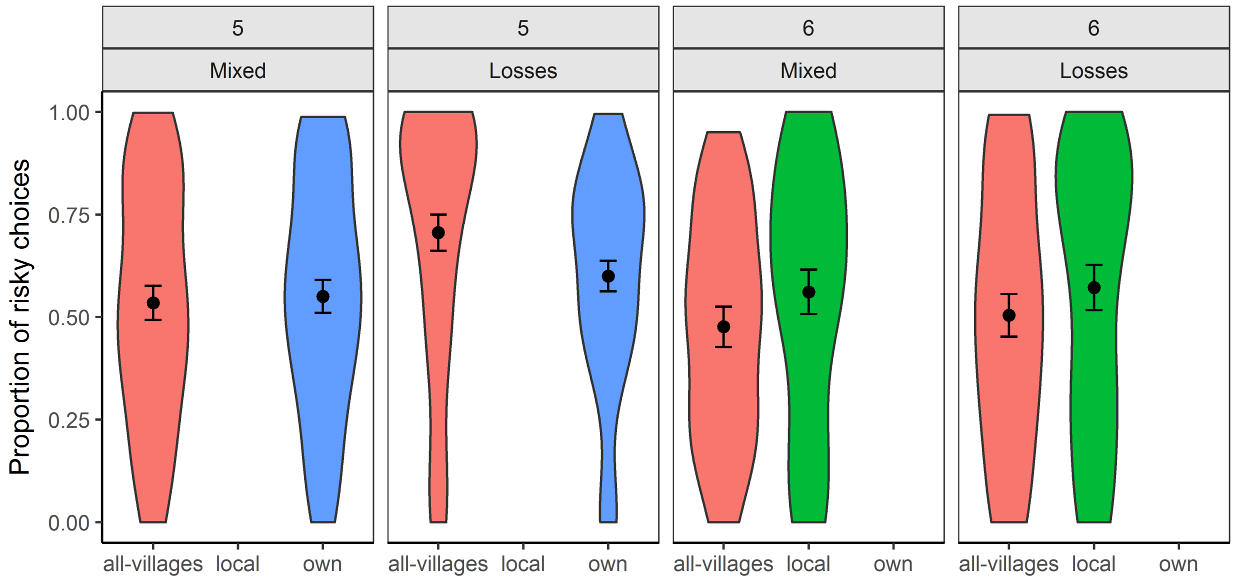

Figure 3. Risky choice proportion as a function of experiment number, framing, and feedback condition (all between-subjects). Error bars depict standard error of the mean. ‘All-villages’ refers to receiving feedback about the occurrence of disasters in all of the villages in the micro-world, ‘local’ refers to receiving feedback only about disasters occurring in the village that the participant is currently living, and ‘own’ refers to feedback for only the selected house.

$F(1, 192) = 2.18$, $p = .14$. There was also insufficient evidence to suggest an effect of feedback, $F(1, 192) = 1.21$, $p = .27$.

Examining the two right panels for Experiment 6, there was a significant effect of environment, $F(1, 135) = 16.80$, $p < .001$, again explained as a higher proportion of risky choices in the moderate environment compared to the severe environment. Contrary to the results of Experiment 5, there was insufficient evidence to suggest an effect of frame, $F(1, 135) = .13$, $p = .72$, or feedback, $F(1, 192) = 2.10$, $p = .15$. Similarly to Experiment 5, there was a significant block $\times$ frame interaction, $F(3, 405) = 3.95$, $p = .009$, explained by declining risky choice proportions over the experiment in the mixed framing compared to relatively stable proportions in the loss framing.

Replication results by block

The figure below departs from the unpublished follow-up experiments and plots results from the replication. The figure depicts risky choice proportions in blocks of 50 trials as a function of feedback. The inclusion of the block factor in the Bayesian ANOVA analysis was explained by the decrease of risky choice proportions over the experiment.

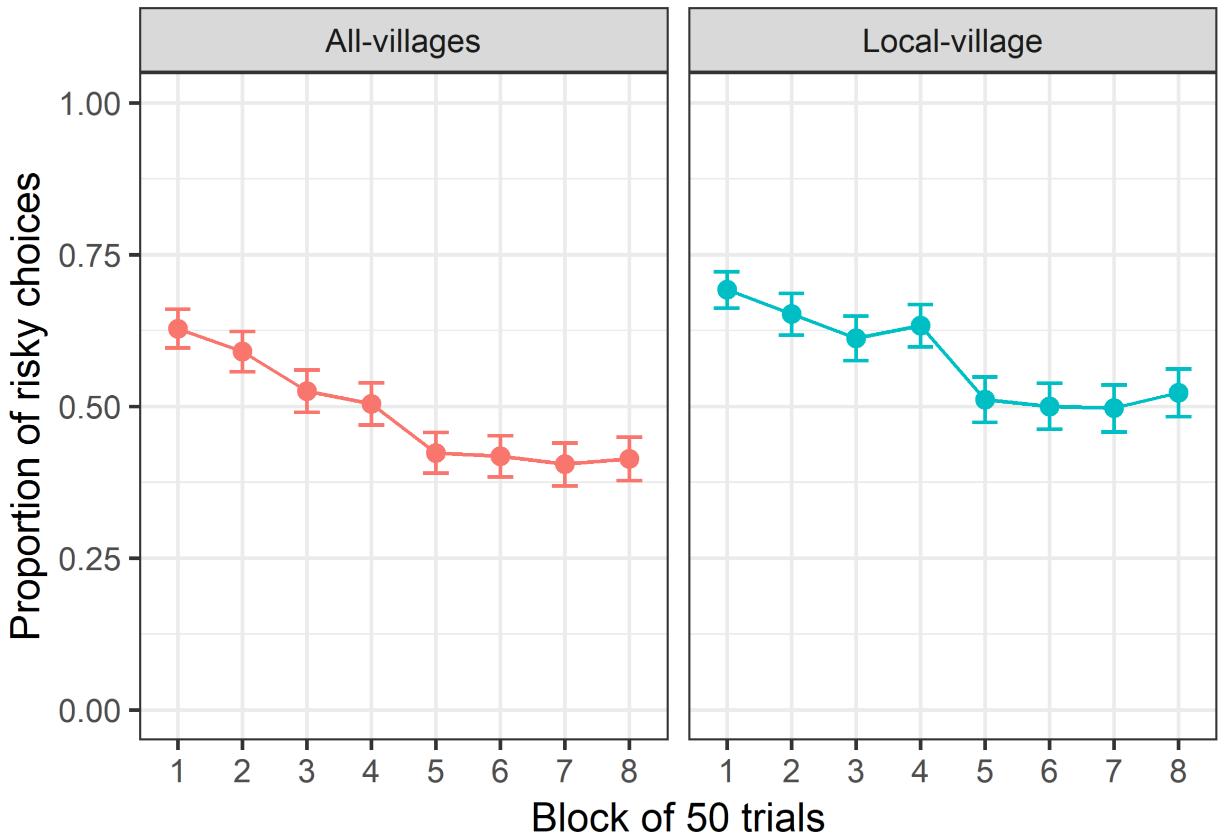

Figure 4. Risky choice proportions as a function of block (50 trials) and feedback. Error bars depict standard error of the mean. Blocks 1-4 were within the moderate environment, and blocks 5-8 were in the severe environment.

Moving cost

On any trial, participants could choose to move houses within their own village, or to another village. The cost of moving was set by the following equation:

$$Cost = 1 + .03 \times \sqrt{\text{Euclidian distance}} + C_i$$

C_i is a constant added to a between village move. The maximum possible move cost is 8.9 points which is a move from the southeastern-most house to the northwestern-most house in another village. The lowest move cost (i.e. to the house next door, within the same village) is 1.7 points. This moving cost calculation is the same as in Newell et al. (2016).

Data availability

The data for the four follow-up experiments are available upon request.

References

Newell, B. R., Rakow, T., Yechiam, E., & Sambur, M. (2016). Rare disaster information can increase risk-taking. *Nature Climate Change*, *6*(2), 158–161.